CALCINER

What is the calciner?

The calciner is a treatment facility that uses heat and airflow to turn liquid high-level waste into a solid.

Liquid waste sprayed as a fine mist into a heated chamber contains beads the size of coarse sand. The chamber circulates the beads like an air popcorn popper, and the heat evaporates the water from the liquid so it forms coatings on the beads. The continued popcorn popper motion constantly chips the coatings off the beads into flakes. The flakes then travel through transport tubes to storage bins.

The calciner may have produced its distinctive orange-brown plume for the last time on May 27, 2000. A combination of monitoring complications, waste treatment difficulties, and regulatory standards led to its shutdown pending the result of a larger decision-making effort for all INEEL high-level waste.

Calcining at the INEEL began in 1963. But calciner operations have not been continuous. They have stopped periodically for as long as several years for maintenance, lack of liquid waste feed, and installation of new equipment.

Nevertheless, the INEEL's two calciners were heralded for their ability to turn liquid waste into solids, drastically reduce waste volume, and render waste easier to handle, store, and transport.

Compare the situations at INEEL and Hanford, a DOE facility in neighboring Washington. Hanford has not had a calciner, and it has 177 tanks of high-level waste, 67 of which are leaking. INEEL, on the other hand, has 11 non-leaking liquid waste tanks and 7 bin sets (storage vessels within concrete silos) of calcined solids. From this perspective, keeping the calciner operating made sense.

But the calciners' air emissions concerned state officials, regulators and the public.

cal•cine \kal-sin\ *vb* cal•cined; cal•cin•ing: to heat to a high temperature but without fusing to drive off volatile matter and often reduce to a powder - cal•ci•na•tion *n*

The "new" calciner, which replaced the INEEL's first calciner in 1982, existed before the federal government was forced to comply with hazardous waste treatment regulations. When the facility became subject to these regulations, INEEL could not monitor emissions in a way that met the U.S. Environmental Protection Agency's approval. Because the facility was treating highly radioactive waste mixed with hazardous chemicals, federal and state regulators were concerned that DOE could not verify facility emissions met standards for hazardous chemicals like mercury.

To some, the solution was easy: shut down the facility. But the situation wasn't that simple. The 11 tanks containing the INEEL's liquid high-level waste sit a few hundred feet above the Eastern Snake River Plain Aquifer, and they, too, do not meet hazardous waste regulations. Getting the liquid converted to a solid has been a top priority of several governors of Idaho and state oversight and regulatory officials.

The 1995 Settlement Agreement required DOE to calcine all non-sodium-bearing liquid waste by 1998 and all sodium-bearing waste by 2012. However, the Agreement also required to DOE to comply with all regulations as it performed its obligations.

Regulators and waste managers tried to balance the need to reduce the volume of liquid high-level waste over the Aquifer with their concerns about emissions. The Idaho Department of Environmental Quality and the U.S. Environmental Protection Agency modified an earlier consent order with INEEL to allow the calciner to operate until June 1, 1999, in an "interim" status designed for facilities in the process of being permitted. Regulators granted a one-year extension to allow the INEEL to test new monitoring methods. Under the consent order, DOE cannot restart the calciner unless it receives a permit for hazardous waste treatment from DEQ.

DOE tentatively decided to close the calciner to meet the terms of its consent order with the state and EPA. DOE is reviewing this decision as part of an Environmental Impact Statement for future management of all of the INEEL's high-level waste—both remaining liquids and waste that has already been calcined.

Monitoring emissions

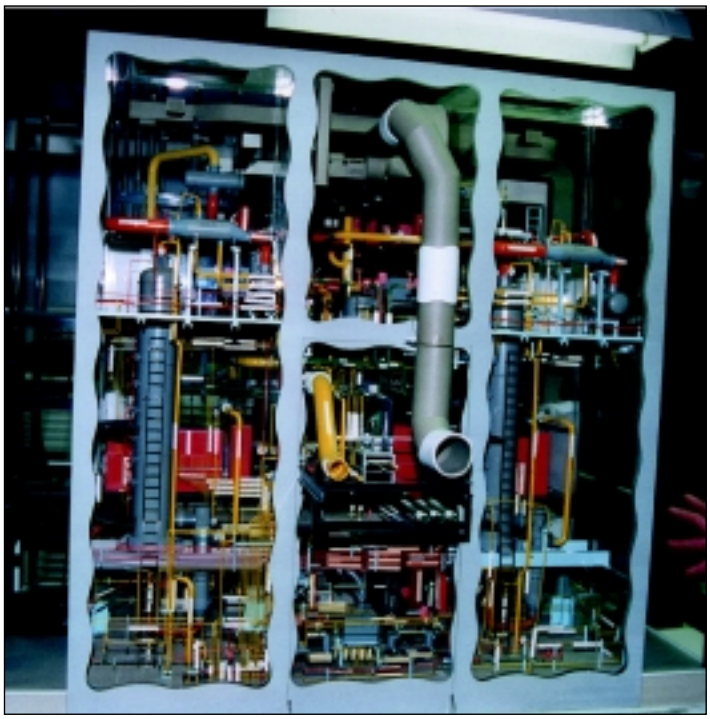
Collecting samples of the calciner's emissions was complicated by two factors. First, the emissions were extremely acidic and "attacked" resins in sample equipment in the calciner stack, making them unusable. Second, samples taken outside the stack included emissions from other facilities, so it was difficult to determine calciner emissions.

In 1999 and 2000, INEEL was able to collect better data about calciner emissions. Organic emissions were not as high as predicted, but emissions of some metals were cause for concern. Carbon monoxide, mercury, and nitrogen oxides were particularly problematic. Also detected was benzene, a carcinogenic organic chemical; lead; and other organic compounds made when nitrogen combined with fuel used in the calciner.

An unused emission sampling device. A resin inside the tube traps contaminants in the emissions.

An emission sampling device that had been in the calciner stack. The acidic off-gasses in the emissions melted or burned up the resin inside the sampler. No data could be collected.

A team of scientists kept changing the sampling protocol until they found a way to make it work. The EPA has not approved the method.



Waste is kept in the calciner's "hot cell" with 4-foot thick walls. You wouldn't want to go in there. But you could look at this model, used to explain the facility's system and plan maintenance activities. Because workers can be inside the facility for only a short time, careful planning is essential.

Some radionuclides were detected, but at levels lower than predicted, and below national standards. EPA sets these standards, called National Emissions Standards for Hazardous Air Pollutants (NESHAPS) to protect human health and the environment.

Sodium-bearing waste

Most of the INEEL's high-level waste is **non-sodium bearing waste,** created during the first cycle in reprocessing of spent nuclear fuel. DOE completed calcining INEEL's non-sodium-bearing waste in 1999.

The waste that results from the later cycles of reprocessing has a different chemical makeup. It's known as **sodium-bearing waste.** Sodium-bearing waste also includes liquids from decontamination.

Technical difficulties stymied efforts to calcine sodium-bearing waste. Waste containing sodium is more difficult to calcine, because sodium makes the calciner mixture gummy instead of dry. Because the calciner moves the material being treated by air, this gumminess tends to clog the system, requiring more shutdowns for maintenance.

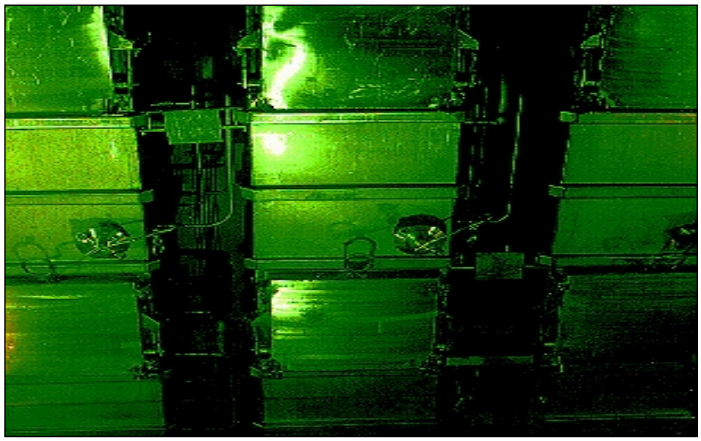
Ironically, calciner operations create more liquid waste. Each time the calciner was shut down, for example, about 50,000 gallons of liquid waste were produced. The system was flushed with nitric acid, which mixed with waste crusted on the bed of the calciner. This waste was normally sent through the calciner when it restarted.

MACT air-quality standard

Key factors in an air quality permit include: the type of pollution control equipment the facility must have, how much and what kinds of monitoring are done in and around the facility, and the frequency of upgrades to equipment and processes.

MACT is the most recent air-quality standard issued by the EPA. It stands for Maximum Achievable Control Technology, and it requires a facility to have the very best pollution control equipment possible. It applies to hazardous air pollutants, or HAPs, a list of chemicals that may cause health problems.

Existing facilities that emit HAPs have until 2002 to meet MACT standards. New facilities must meet the standard as soon as they are built. The calciner was one of several INEEL facilities required to upgrade to meet MACT standards or close.



A series of high-efficiency particulate air, or HEPA, calciner filters. They remove particulates from an air stream, but don't affect gasses.

A common-sense decision

Upgrading the calciner to meet MACT standards and obtain permits would require millions of dollars, and even then, it may not meet standards. So INEEL decided to consider the calciner's fate in the context of a broader evaluation and decision-making process described in the high-level waste section of this report, and put the calciner on permanent "standby" status. The calciner was effectively closed down.